Installation Manual
P/N 20002172, Rev. B
July 2008

Micro Motion®
T-Series Sensor

Installation Manual

Micro Motion®
EMERSON™
Process Management

Before You Begin

This manual describes how to install a Micro Motion® T-Series sensor. The following information is provided in this manual:

Customer service

For technical assistance, phone the Micro Motion Customer Service department:

- In the U.S.A., phone **800-522-MASS** (800-522-6277) (toll free)
- In Canada and Latin America, phone +1 303-527-5200 (U.S.A.)
- In Asia:
  - In Japan, phone 3 5769-6803
  - In other locations, phone +65 6777-8211 (Singapore)
- In Europe:
  - In the U.K., phone 0870 240 1978 (toll-free)
  - In other locations, phone +31 (0) 318 495 555 (The Netherlands)

Customers outside the U.S.A. can also email Micro Motion customer service at *International.MMISupport@EmersonProcess.com*.

Troubleshooting

Refer to the transmitter manual for troubleshooting help.

Specifications

Full product specifications can be found in the T-Series Product Data Sheet, which is available from the Micro Motion web site at **www.micromotion.com**.

Definitions

The term *MVD™ transmitter* refers to the following transmitter models:

- Models 1500, 1700, 2500, and 2700
- Models 3500 and 3700 with sensor interface code 5 or 6

European installations

This Micro Motion product complies with all applicable European directives when properly installed in accordance with the instructions in this manual. Refer to the EC declaration of conformity for directives that apply to this product.

The EC declaration of conformity, with all applicable European directives, and the complete *ATEX Installation Drawings and Instructions* are available on the internet at **www.micromotion.com/atex** or through your local Micro Motion support center.

Information affixed to equipment that complies with the Pressure Equipment Directive can be found on the internet at **www.micromotion.com/documentation**.

Purge plugs

If you remove a purge plug from the sensor case, it will be necessary to repurge the case. Refer to *Case purging procedure* on page 14 for more information about repurging the sensor case.

Removing a purge plug compromises the secondary containment of the sensor and could expose the user to process fluid. The sensor case may contain process fluid. Take all necessary precautions when removing the purge plug

Installation options

The T-Series sensor makes up one part of a Coriolis flowmeter. The other part is a transmitter. T-Series sensors are available with the following electronics interfaces:

- An integral core processor for connecting to a 4-wire remotely mounted transmitter or to a user-supplied remote host (see Figure 1).
- An integrally mounted Model 1700 or 2700 transmitter (see Figure 2).
- A 9-wire junction box for connecting to a remotely mounted transmitter or a remotely mounted core processor (see Figure 3).

Figure 1 T-Series sensor with core processor

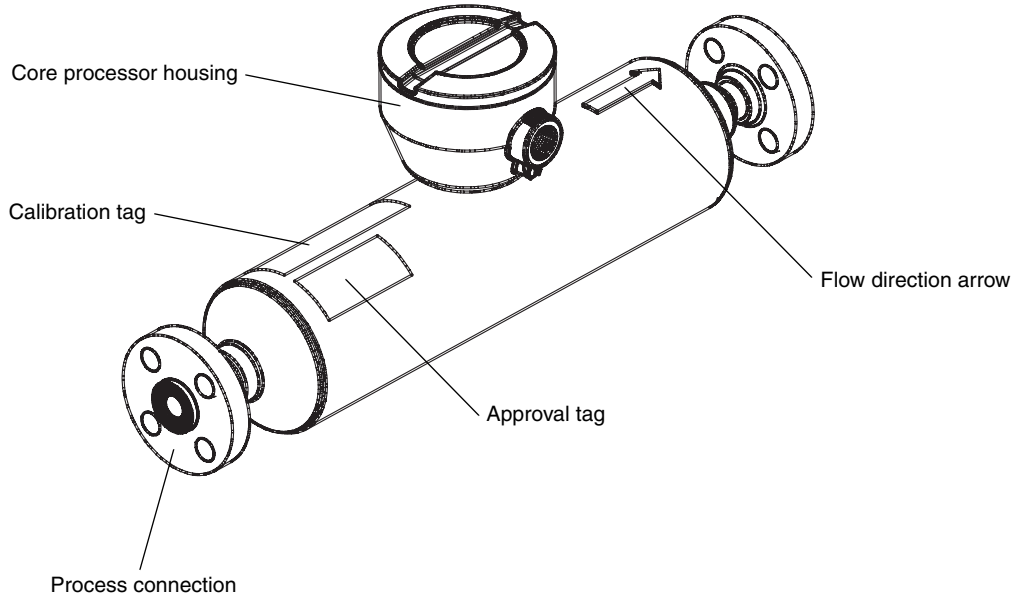


Figure 2 T-Series sensor with integrally mounted Model 1700/2700 transmitter

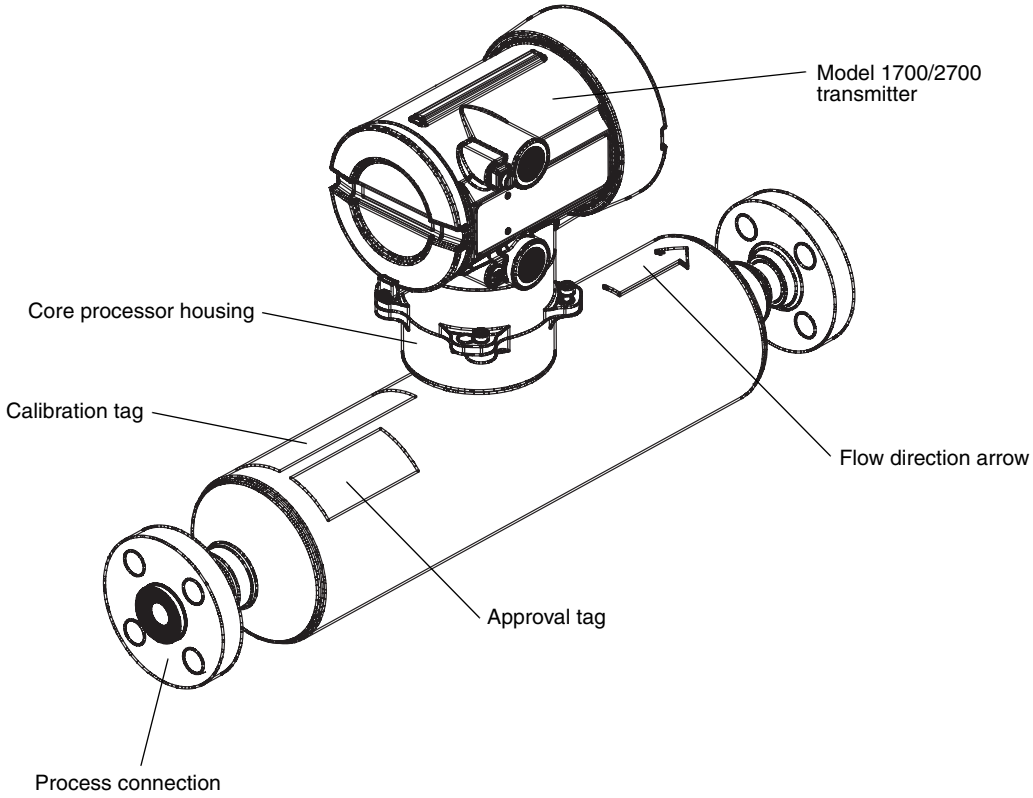
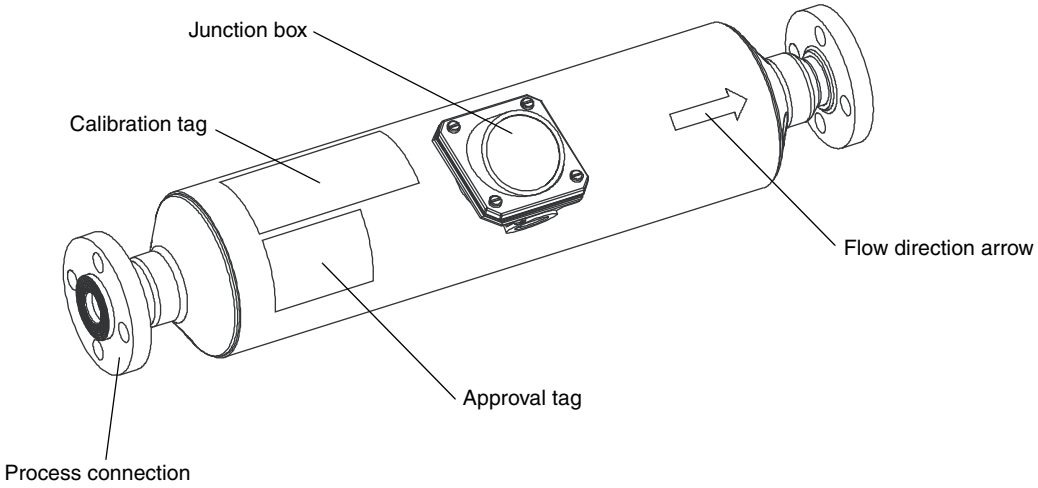


Figure 3 T-Series sensor with junction box



Step 1 Determining a Location

Choose a location for the sensor based on the requirements described in this section. The following general guidelines can help you select an appropriate location for the sensor.

Full flow tubes

For optimal performance, the sensor tubes should remain full of process fluid.

Hazardous area installations

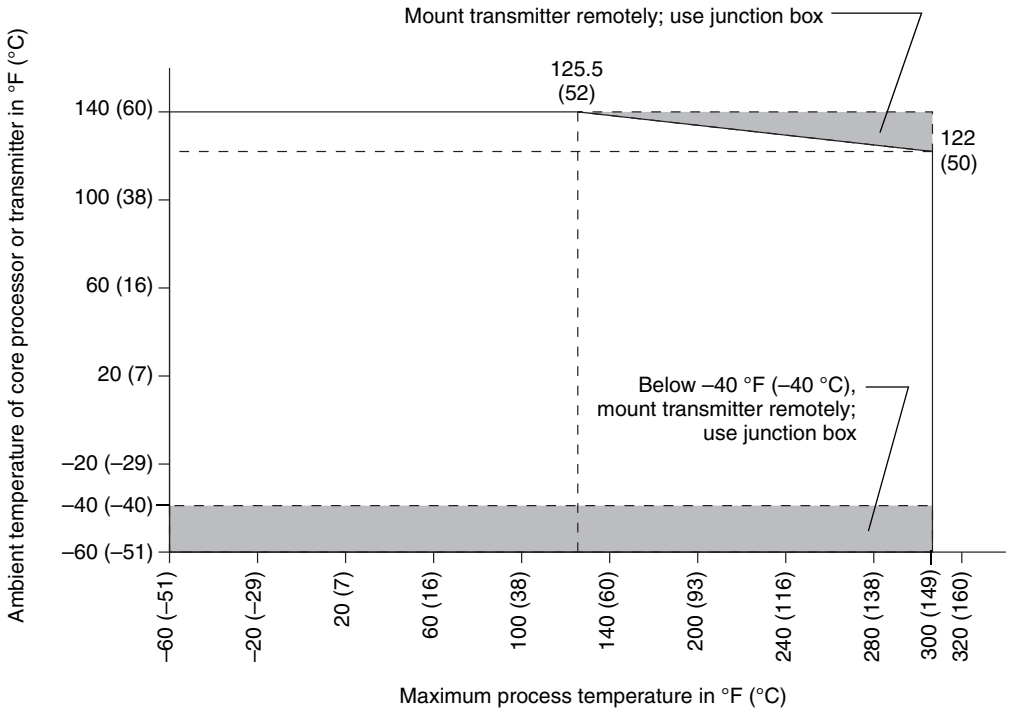
Make sure the hazardous area specified on the sensor approval tag is suitable for the environment in which the sensor is installed. (See Figures 1–3.) For installation in an area that requires intrinsic safety, refer to the appropriate Micro Motion approval documentation, shipped with the sensor or available from the Micro Motion web site at **www.micromotion.com**.

Improper installation in a hazardous area can cause an explosion. When installing in a hazardous area, refer to Micro Motion approvals instructions, shipped with the product or available from the Micro Motion web site. For hazardous installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

Environmental limits

The ambient and process temperature limits of the sensor are shown in Figure 4.

Figure 4 T-Series sensor ambient and process temperature limits



* *When ambient temperature is below –40 °F (–40 °C), a core processor must be heated to bring its local ambient temperature to between –40 °F (–40 °C) and +140 °F (+60 °C). Long-term storage of electronics at ambient temperatures below –40 °F (–40 °C) is not recommended.*

* *For the purposes of selecting electronics options, this graph should be used only as a general guide. If your process conditions are close to the gray areas, it may be inappropriate to use electronics options other than a junction box. Consult with your Micro Motion representative.*

Hazardous area approvals may impose additional limits on ambient and process temperature. For the ATEX "T" rating, refer to the ATEX documentation shipped with the sensor or available on the Micro Motion web site at **www.micromotion.com**. UL and CSA ambient temperature limits are listed in Table 1.

Table 1 UL and CSA ambient temperature limits

	Electronics	°F	°C
UL	Sensor with junction box	+104 maximum	+40 maximum
	Sensor with core processor or integral transmitter	–40 to +140	–40 to +60
CSA	Sensor with junction box	+140 maximum	+60 maximum
	Sensor with integral Model 1700/2700 transmitter	–40 to +140	–40 to +60

Maximum wiring distances

If the transmitter is mounted remotely from the sensor, the maximum distance between the sensor and transmitter depends on cable type. See Table 2.

Table 2 Maximum cable lengths

Cable type	Wire size	Maximum length
Micro Motion 9-wire to an MVD transmitter or core processor	Not applicable	60 feet (20 meters)
Micro Motion 9-wire to all other transmitters	Not applicable	1000 feet (300 meters)
Micro Motion 4-wire	Not applicable	1000 feet (300 meters)
User-supplied 4-wire(1)		
Power wires (VDC)	22 AWG (0,35 mm^2)	300 feet (90 meters)
	20 AWG (0,5 mm^2)	500 feet (150 meters)
	18 AWG (0,8 mm^2)	1000 feet (300 meters)
Signal wires (RS-485)	22 AWG (0,35 mm^2) or larger	1000 feet (300 meters)

(1) Micro Motion recommends using Micro Motion cable.

Pipe run

Micro Motion sensors do not require a straight run of pipe upstream or downstream.

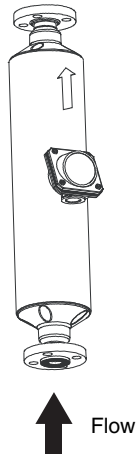
Valves

After the sensor and transmitter have been installed, you must perform the zeroing procedure. During the zeroing procedure, flow through the sensor must be halted and the sensor tubes must be completely full of process fluid. A shutoff valve, downstream from the sensor, is recommended to halt flow during the zeroing procedure. For more information about zeroing, refer to the instruction manual shipped with the transmitter.

Step 2 Orienting the Sensor

The sensor will function properly in any orientation if the sensor tubes remain filled with process fluid. Micro Motion recommends orienting the sensor in a vertical pipeline, with process fluid flowing upward through the sensor (see Figure 5).

Figure 5 Recommended sensor orientation



Self-draining applications

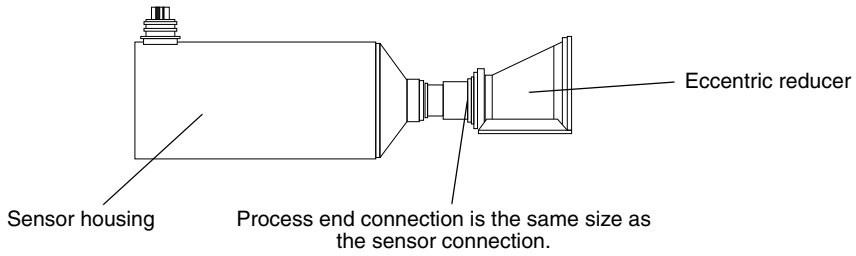
T-Series sensors can be installed to be self-draining in any orientation.

Hygienic applications

For optimal cleanability and drainability, follow these guidelines:

- Install the sensor in a vertical pipeline if possible.
- If the sensor must be installed in a horizontal pipeline, the process piping and sensor tubing should have the same internal diameter (ID). The process end connections for the piping and sensor must be the same size. Only sanitary fittings are compatible with a horizontal orientation.
- For clean-in-place (CIP) applications, Micro Motion recommends using the generally-accepted flow velocity of at least 1.5 m/s for cleaning the sensor.
- If the process piping must be larger than the sensor, eccentric reducers may be used to ensure full drainability. In this case, the process end connections for the piping and sensor must be the same size. See Figure 6.

Figure 6 Eccentric reducer



Note: As part of the cleaning process, skid-based systems may be purged with nitrogen at the end of the cleaning cycle. When using eccentric reducers, it is possible to trap gas in the section of process piping adjacent to the reducer. Sensor performance can be impacted by intermittent flow of the captured gas in a liquid fluid stream.

- The gap between the electronics housing and sensor body should be inspected periodically. Manually clean this gap when necessary.
- The ASME Bioprocess Equipment Standard (ASME BPE-1997), section SC-3.12.1, includes recommendations regarding how to install process piping to ensure full drainability. In general, the ASME BPE-1997 guideline recommends a minimum drop of ¼ in/ft (2 cm/m) of piping. The angle of the process piping can have an impact on the reducer length in the sloping process line.

Flow direction arrow

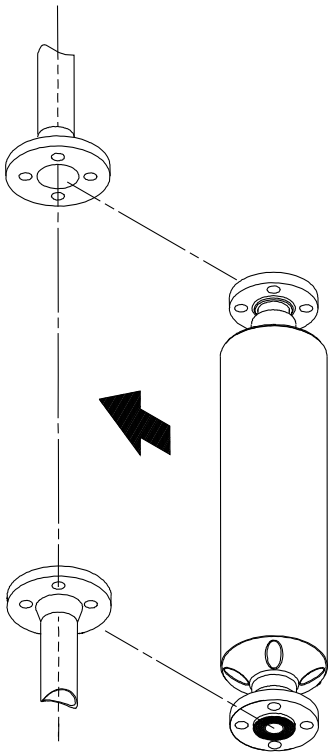
The sensor has a flow direction arrow (see Figures 1–3) to help you configure the transmitter for flow direction. If possible, install the sensor so that the flow direction arrow matches actual process flow.

Step 3 Mounting the Sensor

Use your common practices to minimize torque and bending load on process connections. To reduce the risk of condensation or excessive moisture, the conduit opening should not point upward (if possible). The conduit opening of the junction box or core processor can be rotated freely to facilitate wiring.

Figure 7 illustrates how to mount the sensor. Do not use the meter to support the piping.

Figure 7 Mounting a T-Series sensor



Step 4 Wiring

Hazardous area installations

If you are installing the sensor in a hazardous location, verify that the hazardous classification information printed on the sensor tag matches the environment in which the sensor will be installed.

Failure to comply with the requirements for intrinsic safety in a hazardous area could result in an explosion. Make sure the hazardous area specified on the sensor approval tag is suitable for the environment in which the sensor will be installed.

Improperly sealed housings can expose electronics to moisture, which can cause measurement error or flowmeter failure. Inspect and grease all gaskets and O-rings. Fully close and tighten all housing covers and conduit openings.

Installation options

The sensor has one of the following configurations:

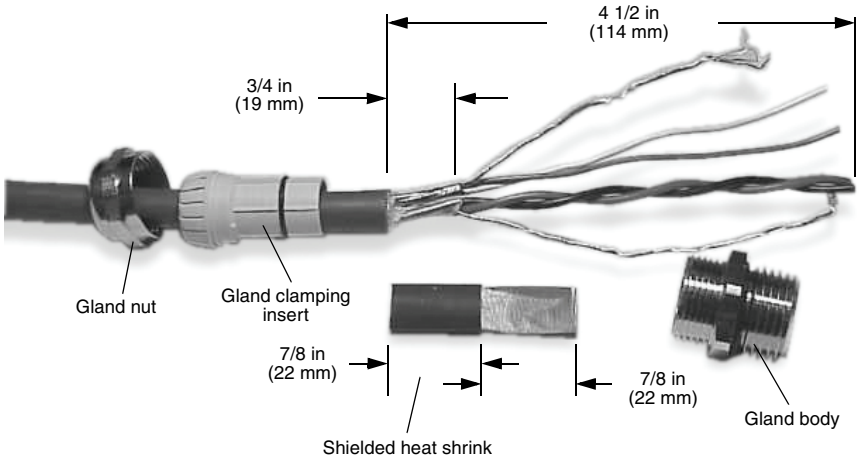
- An integrally mounted Model 1700/2700 transmitter. No wiring is required between the sensor and the transmitter. Skip to *Grounding* on page 14.
- A core processor to a 4-wire remote transmitter (requires 4-wire cable); see *Core processor to a 4-wire remote transmitter* on page 10.
- A core processor to a remote host (requires 4-wire cable); refer to the *Micro Motion MVD™ Direct Connect™ Flowmeter Installation Manual*.
- A junction box to a 9-wire remote transmitter or remote core processor (requires 9-wire cable); see *Junction box to a 9-wire remote transmitter or remote core processor* on page 13.

Core processor to a 4-wire remote transmitter

Follow the steps below to connect the 4-wire cable between the core processor and the transmitter.

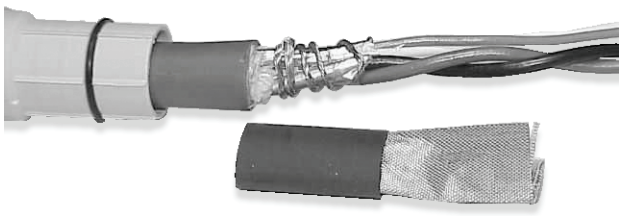
1. Use one of the following methods to shield the wiring from the core processor to the transmitter:
   - If you are installing unshielded wiring in continuous metallic conduit that provides 360° termination shielding for the enclosed wiring, go to page 12 (step 6 of the wiring procedure).
   - If you are installing a user-supplied cable gland with shielded cable or armored cable, terminate the shields in the cable gland. Terminate both the armored braid and the shield drain wires in the cable gland. Never connect the drain wires to the internal ground screw of the core processor. Go to page 12 (step 6 of the wiring procedure).
   - If you are installing a Micro Motion-supplied cable gland at the core processor housing:
     - Prepare the cable and apply shielded heat shrink as described below. The shielded heat shrink provides a shield termination suitable for use in the gland when using cable whose shield consists of foil and not a braid. Proceed to step 2 of the wiring procedure, below.
     - With armored cable, where the shield consists of braid, prepare the cable as described below, but do not apply heat shrink. Proceed to step 2 of the wiring procedure, below.
2. Remove the cover from the core processor housing.
3. Slide the gland nut and the clamping insert over the cable.

Figure 8 Micro Motion cable gland and heat shrink



4. For connection at the core processor housing, prepare shielded cable as follows (for armored cable, omit steps d, e, f, and g):
   a. Strip 4 1/2 inches (114 mm) of cable jacket.
   b. Remove the clear wrap that is inside the cable jacket, and remove the filler material between the wires.
   c. Remove the foil shield that is around the insulated wires, leaving 3/4 inch (19 mm) of foil or braid and drain wires exposed, and separate the wires.
   d. Wrap the shield drain wire(s) around the exposed foil twice. Cut off the excess wire.

Figure 9 Wrapping the shield drain wires

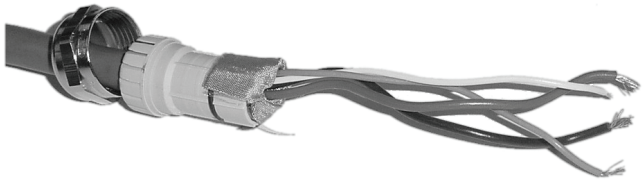


   e. Place the shielded heat shrink over the exposed shield drain wire(s). The tubing should completely cover the drain wires.
   f. Without burning the cable, apply heat (250 °F or 120 °C) to shrink the tubing.

Figure 10 Applying the heat shrink

g. Position gland clamping insert so the interior end is flush with the heat shrink.
h. Fold the cloth shield or braid and drain wires over the clamping insert and approximately 1/8 inch (3 mm) past the O-ring.

Figure 11 Folding the cloth shield

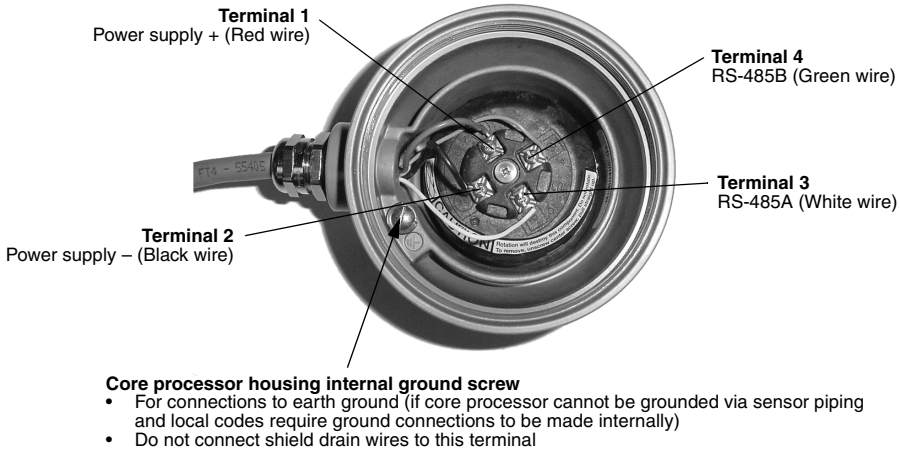


i. Install the gland body into the core processor housing conduit opening.

Figure 12 Gland body and core processor housing

5. Insert the wires through the gland body and assemble the gland by tightening the gland nut. If desired, leave sufficient wire length inside the core processor housing to allow the housing to rotate without damaging the wires.
6. Identify the wires in the 4-wire cable. The 4-wire cable supplied by Micro Motion consists of one pair of 18 AWG (0,80 mm^2) wires (red and black), which should be used for the VDC connection, and one pair of 22 AWG (0,35 mm^2) wire (green and white), which should be used for the RS-485 connection. Connect the four wires to the numbered slots on the core processor (Figure 13).

Figure 13 Connecting the wires at the core processor



7. Reinstall and tighten the core processor housing cover.
8. Additional wiring instructions for the transmitter can be found in the transmitter manual.

   Note: Never ground the 4-wire cable shield and shield drain wire(s) at the transmitter.

Junction box to a 9-wire remote transmitter or remote core processor

Follow the steps below to connect the 9-wire cable between the sensor and the transmitter or core processor.

1. Prepare and install the cable according to the instructions in Micro Motion's *9-Wire Flowmeter Cable Preparation and Installation Guide*.
2. Insert the stripped ends of the individual wires into the terminal blocks. No bare wires should remain exposed.
3. Match the wires color for color. For wiring at the transmitter or remote core processor, refer to the transmitter documentation.
4. Tighten the screws to hold the wires in place.
5. Ensure integrity of gaskets, then tightly close and seal the junction box cover and all housing covers on the transmitter or core processor.

Step 5 Grounding

The sensor can be grounded via the piping if the joints in the pipeline are ground-bonded. If the sensor is not grounded via the piping, connect a ground wire to the internal or external grounding screw, which is located on the core processor housing or junction box.

Improper grounding can cause measurement error. Ground the flowmeter to earth, or follow ground network requirements for the facility.

If national standards are not in effect, follow these guidelines to ground the sensor:

- Use copper wire, 14 AWG (2,0 mm²) or larger wire size for grounding.
- Keep all ground leads as short as possible, less than 1 ohm impedance.
- Connect ground leads directly to earth, or follow plant standards.

Purge Fittings

If the sensor has purge fittings, they should remain sealed at all times. After a purge plug has been removed, the sensor case should be purged with argon or nitrogen and resealed.

Purging the case protects internal components. The sensor is purged of all oxygen and sealed at the factory. If the purge plugs are never removed, it is not necessary to purge or re-seal the sensor. For more information, contact Micro Motion Customer Service.

Removing a purge plug

If a purge plug is removed from the sensor case, it will be necessary to repurge the case.

Removing a purge plug compromises the secondary containment of the sensor and could expose the user to process fluid. Take all necessary precautions when removing purge plugs.

Improper pressurization of the sensor case could result in personal injury. Removing a purge plug will require the sensor case to be repurged with a dry inert gas. Follow all instructions provided in the case purging procedure.

Case purging procedure

Read all instructions before performing the case purging procedure. It is not necessary to perform this procedure unless a purge plug has been removed.

1. Shut down the process, or set control devices for manual operation.

Performing the purge procedure while the flowmeter is operating could affect measurement accuracy, resulting in inaccurate flow signals. Before performing the case purging procedure, shut down the process, or set control devices for manual operation.

2. Remove both purge plugs from the sensor case. If purge lines are being used, open the valve in the purge lines.
3. Prepare the purge plugs for reinstallation by wrapping them with 3–5 turns of Teflon® tape.

4. Connect the supply of nitrogen or argon gas to the inlet purge connection or open inlet purge line. Leave the outlet connection open.
   - Exercise caution to avoid introducing dirt, moisture, rust, or other contaminants into the sensor case.
   - If the purge gas is heavier than air (such as argon), locate the inlet lower than the outlet, so the purge gas will displace air from bottom to top.
   - If the purge gas is lighter than air (such as nitrogen), locate the inlet higher than the outlet, so the purge gas will displace air from top to bottom.
5. Make sure there is a tight seal between the inlet connection and sensor case, so air cannot be drawn by suction into the case or purge line during the purging process.
6. The purge time is the amount of time required for full exchange of atmosphere to inert gas. For each sensor size, the purge time is different. Refer to Table 3. If purge lines are being used, increase the purge time to fill the additional volume of the purge line.
7. Avoid pressurizing the sensor case. At the appropriate time, shut off the gas supply, then immediately seal the purge outlet and inlet connections with the purge plugs. If pressure inside the case elevates above atmospheric pressure during operation, the flowmeter density calibration will be inaccurate.
8. Make sure the purge fitting seals are tight so air cannot be drawn by suction into the sensor case.

Table 3 Time required to purge T-Series sensor cases

Sensor model	**Purge rate** *ft^3/hr (l/hr)*	**Time**[1] *minutes*
T025	20 (566)	1
T050	20 (566)	1
T075	20 (566)	3
T100	20 (566)	5
T150	20 (566)	10

(1) If purge lines are being used, increase purge time to fill the additional volume.

Return Policy

Micro Motion procedures must be followed when returning equipment. These procedures ensure legal compliance with government transportation agencies and help provide a safe working environment for Micro Motion employees. Failure to follow Micro Motion procedures will result in your equipment being refused delivery.

Information on return procedures and forms is available on our web support system at **www.micromotion.com**, or by phoning the Micro Motion Customer Service department (see page 1).

New and unused equipment

Only equipment that has not been removed from the original shipping package will be considered new and unused. New and unused equipment requires a completed Return Materials Authorization form.

Used equipment

All equipment that is not classified as new and unused is considered used. This equipment must be completely decontaminated and cleaned before being returned.

Used equipment must be accompanied by a completed Return Materials Authorization form and a Decontamination Statement for all process fluids that have been in contact with the equipment. If a Decontamination Statement cannot be completed (e.g., for food-grade process fluids), you must include a statement certifying decontamination and documenting all foreign substances that have come in contact with the equipment.

For the latest Micro Motion product specifications, view the PRODUCTS section of our web site at www.micromotion.com

Micro Motion Inc. USA
Worldwide Headquarters
7070 Winchester Circle
Boulder, Colorado 80301
T +1 303-527-5200
+1 800-522-6277
F +1 303-530-8459

Micro Motion Europe
Emerson Process Management
Neonstraat 1
6718 WX Ede
The Netherlands
T +31 (0) 318 495 555
F +31 (0) 318 495 556

Micro Motion Asia
Emerson Process Management
1 Pandan Crescent
Singapore 128461
Republic of Singapore
T +65 6777-8211
F +65 6770-8003

Micro Motion United Kingdom
Emerson Process Management Limited
Horsfield Way
Bredbury Industrial Estate
Stockport SK6 2SU U.K.
T +44 0870 240 1978
F +44 0800 966 181

Micro Motion Japan
Emerson Process Management
1-2-5, Higashi Shinagawa
Shinagawa-ku
Tokyo 140-0002 Japan
T +81 3 5769-6803
F +81 3 5769-6844

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